ARMORED MEDICAL RESEARCH LABORATORY
Fort Knox, Kentucky

SPMEA 741
Project No. 6-5

19 April 1946

REPORT ON WILD HEERBRUGG RANGEFINDER, 80cm BASE, 1944

1. PROJECT: No. 6 - Vision in Tanks. First Partial Report on Sub-Project No. 6-5, Investigation of Short Base Rangefinders.

a. Authority - Letter Commanding General, Headquarters, Armored Force, Fort Knox, Kentucky, File 400.112/6 GNOHD, dated September 24, 1942.

b. Purpose - To evaluate Wild Heerbrugg, 80cm, Rangefinder for purposes of comparison with similar instruments used by the armed forces of the United States.

2. DISCUSSION:

a. Laboratory tests and a break-down inspection of the instrument have been compared with data and drawings given in TM 9-1585, Ordnance Maintenance, Rangefinders, 1-meter Base and 80cm Base, all types.

b. A discussion of the results of these tests is given in the appendices.

3. CONCLUSIONS:

a. This rangefinder is very similar to the US M1916 rangefinder both in design and performance.

b. The Heerbrugg instrument offers no improvement over the US M1916 model and is in some respects inferior.

4. RECOMMENDATIONS:

That no further consideration be given this instrument.

NOTE: The recommendations as set forth in this project have been concurred in by Lt. Colonel J. R. Pritchard, Chairman, Weapons and Ammunition Section, Army Ground Forces Board No. 2.

Submitted by:
Tec 5 D. J. Howe

APPROVED: Frederick J. Knoblauch
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Lt. Colonel, Medical Corps
Commanding

3 Incls.
#1 - Appendix I - Description of Rangefinder
#2 - Appendix II - Optical Characteristics of Rangefinder
#3 - Figures 1 thru 6

Appendix I

DESCRIPTION OF RANGEFINDER

1. The rangefinder and accessories are shown in Fig. 1. The instrument is an 80cm base, invert split field rangefinder. It is carried in a metal case provided with pack straps. Included in the case is an adjusting lath, a 31" wooden tripod with a demountable 12" metal tripod fitted with a ball and socket mount for the rangefinder, an amber filter and a neutral density filter to be mounted in the eyepiece, a lens cleaning cloth and brush, and a key to unlock the infinity adjustment cover.

2. The field of view is rectangular. The invert image appears in a smaller rectangular field above the center of the large field. The large field moves to obtain coincidence, while the small invert field moves to obtain the infinity and halving adjustments.

3. The range adjustment is made by means of a knob beside the right handle of the instrument. The range scale appears both in a window in the front of the instrument and in the left eyepiece. The infinity and halving adjustments are in the left arm of the rangefinder. A rotating, locking cover prevents the infinity adjustment from being accidently changed. A scale is provided, visible through a window in the left arm of the instrument, to allow the infinity adjustment to be reset.

4. Fig. 2 shows the optical bar of the instrument. It is stamped from alloy steel tubing and all parts mounted on it are located by means of positioning screws. It is positioned in the body tube on the left end by three bearing surfaces, one spring loaded, and on the right end by a ball and socket, and a ball and slot suspension. These details are identical with the US M1916 rangefinder.

5. The optical system of the rangefinder is shown in Fig. 3. Coincidence is obtained by means of a sliding wedge behind the right objective. The translucent plastic scale is attached directly to this wedge, moving past the index as the wedge moves in the tube. The infinity adjustment is made by means of a rotating wedge in front of the left pentaprism. A detail of the worm and pinion movement used for this adjustment is shown in Fig. 4. Although this arrangement should be more stable than the gear and pinion adjustment of the US M1916 rangefinder, tests show that the shock of dropping this end of the rangefinder six inches, disturbed the adjustment by as much as two divisions. This could probably be improved by spring or friction loading the worm and pinion. The halving adjustment is made by tilting the left pentaprism.

6. The major difference between this model and the US M1916 rangefinder is in the occular prism system. Fig. 5 shows the prism used. It is similar to the type used in the M1914 and M1917 series, but of simpler construction, using three prisms instead of four. Although this prism system can be more easily manufactured, it places the eyepiece at an angle of 60 degrees from the vertical. This would be especially disadvantageous when mounted externally on a tank as it would require a high head position. A horizontal eyepiece would seem best for this purpose. Fig. 6 shows the mounting of the occular prism.

7. The rubber eyecup is unsatisfactory. Because of the small exit pupil, the eye position is critical. A dual eyecup headrest such as is used on American rangefinders and tank sights would be a great improvement, both from the standpoint of eye positioning and as an aid in steadying the instrument against changes in elevation.

8. The instrument has no thermal insulation around the cast metal tube. Although no tests were made, it is believed that rather large temperature differentials would be produced withing the tube by exposure to sunlight, resulting in distortion of the optical bar and thus decrease the accuracy of the instrument.

Appendix II

OPTICAL CHARACTERISTICS OF RANGEFINDER

1. The pertinent data is listed below:

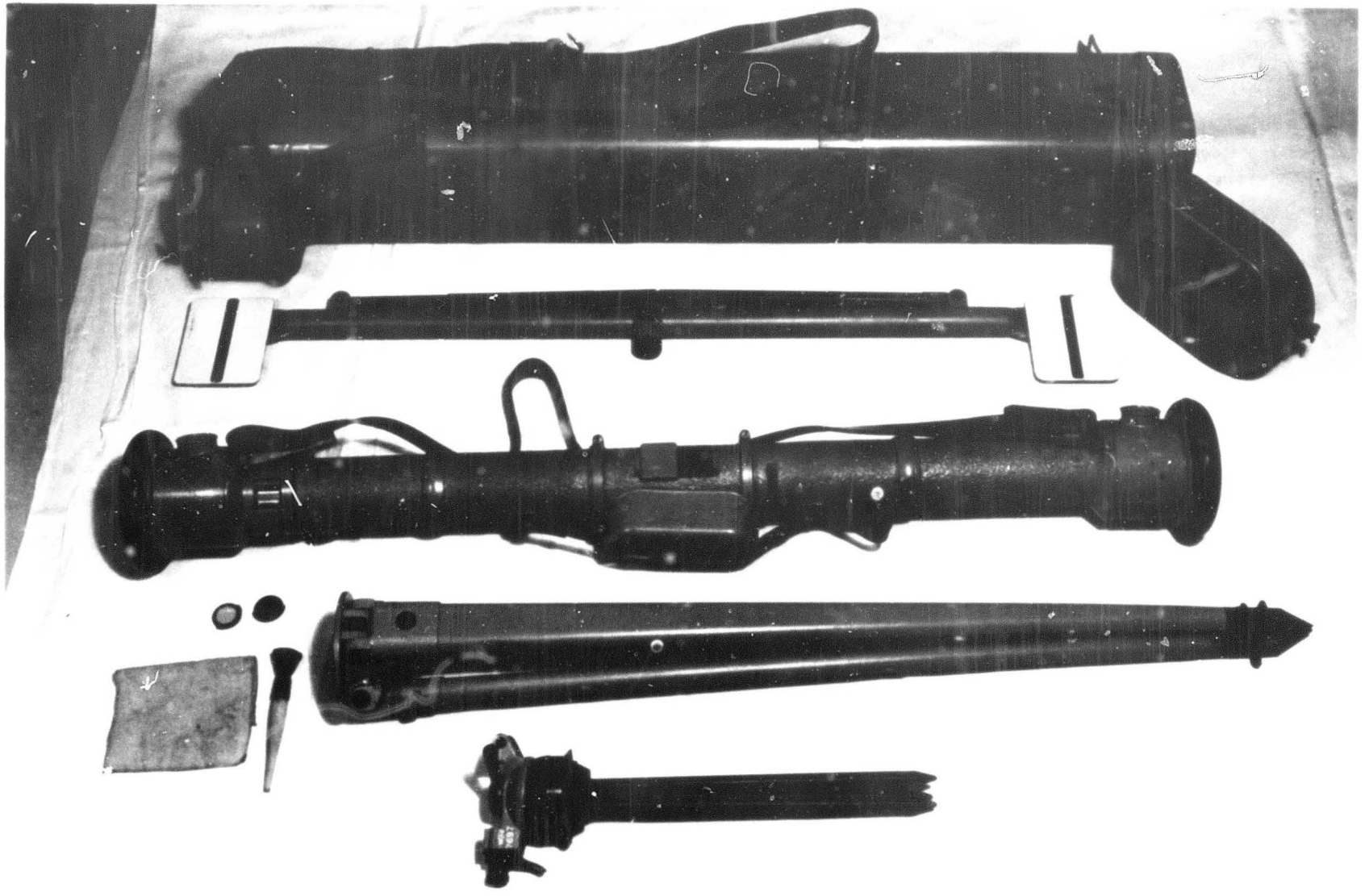
Power	11.2
Real field	
Horizontal	3 degrees
Vertical	2 degrees - 25 minutes
Exit pupil	2.11 mm
Resolving power	5 seconds

These values closely approximate those of American 80cm rangefinders. Optically, the instrument is satisfactory. The resolution is good enough for all but the best observers. A slight loss of resolution would probably be unnoticable as vernier acuity remains in the absence of resolution. The resolution measured is very close to the theoretical maximum for an objective of the diameter used. The optical elements are uncoated. Coating is advisable in an instrument of this type because of the large number of glass surfaces (16 in right arm, 18 in left arm). Good contrast is an aid in making the coincidence setting. The contrast in this instrument is rather poor.

2. No tests were made of the accuracy of the instrument. As no serious optical defects were found, this instrument should compare favorably with other 80cm instruments. In the absence of defects, the accuracy is theoretically a function of the range and the base length of the instrument. The standard German unit of error in making a coincidence setting is 10" (US unit of error - 12"). Using a 10" unit of error, the expected accuracy is:

Meters	Error in Meters
300	.5
1000	5.5
10000	550.
20000	2200.

In actual practice the accuracy is greatly dependent upon the skill of the observer. At short ranges the scale is graduated in units of ten meters which does not utilize the full accuracy of the instrument, while at longer ranges the scale closely approximates the computed accuracy. This does not necessarily indicate poor design however, as extreme accuracy is not necessary at short ranges when used for flat trajectory fire control. It may also be noted that rangefinder accuracy rarely meets the one unit of error specification, although most instruments are designed to meet this condition under optimum conditions.



Project No.6-5 WILD HEERBRUGG RANGE-FINDER AND ACCESSORIES Fig. 1

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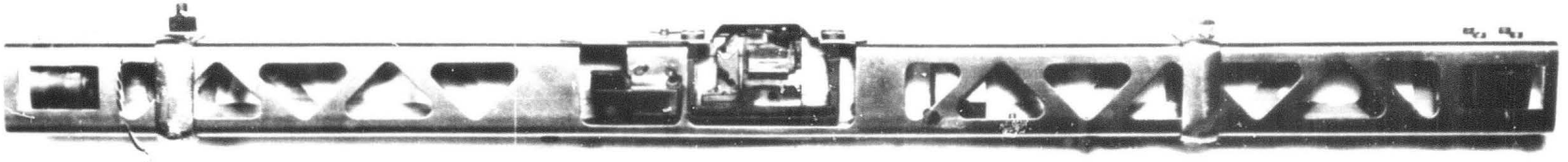

Project No.6-5 OPTICAL BAR OF WILD HEERBRUGG RANGE FINDER Fig. 2

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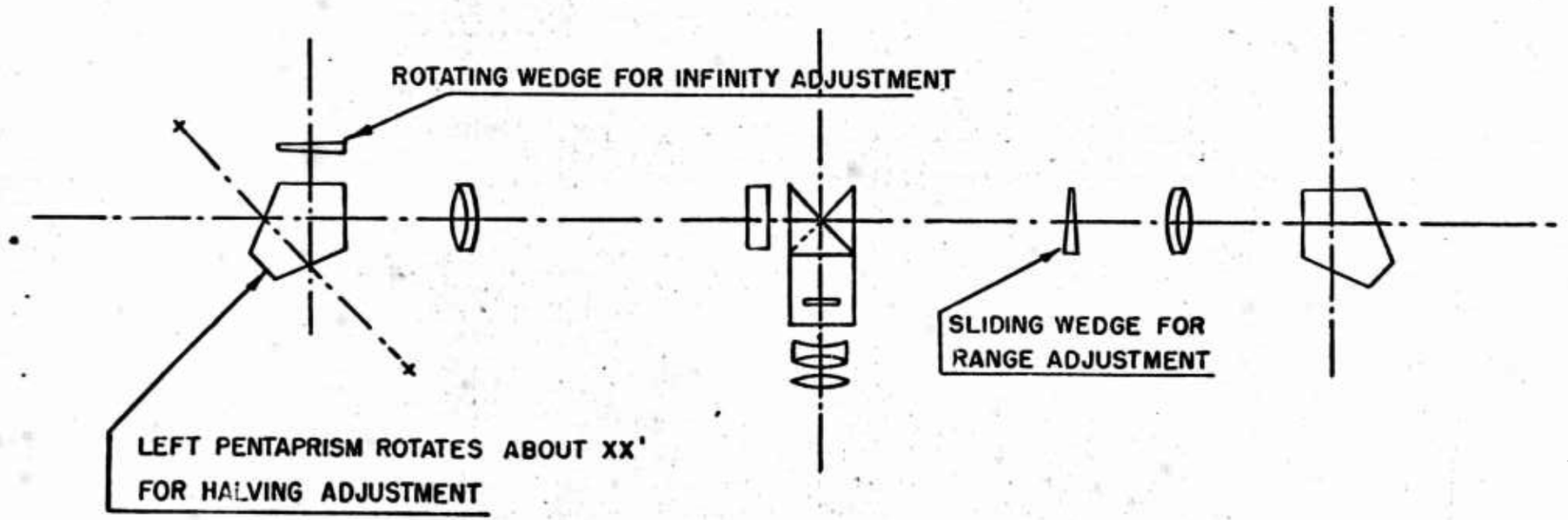
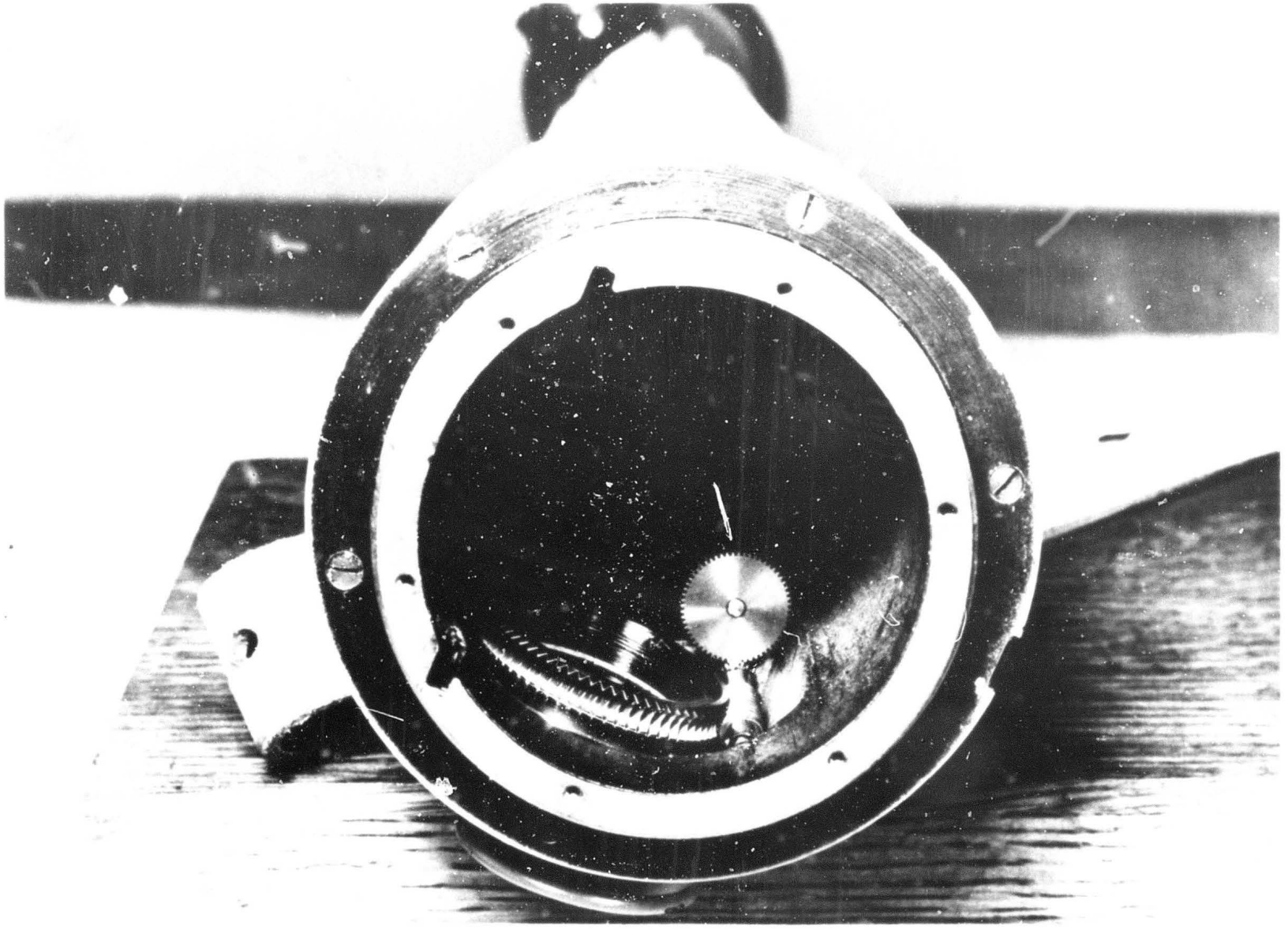
OPTICAL SYSTEM OF HEERBRUGG RANGEFINDER, 80 CM, 1944



NOT TO SCALE

FIGURE 3

INCL. 3



Project No.6-5 INFINITY ADJUSTMENT OF WILD HEERBRUGG RANGEFINDER Fig. 4

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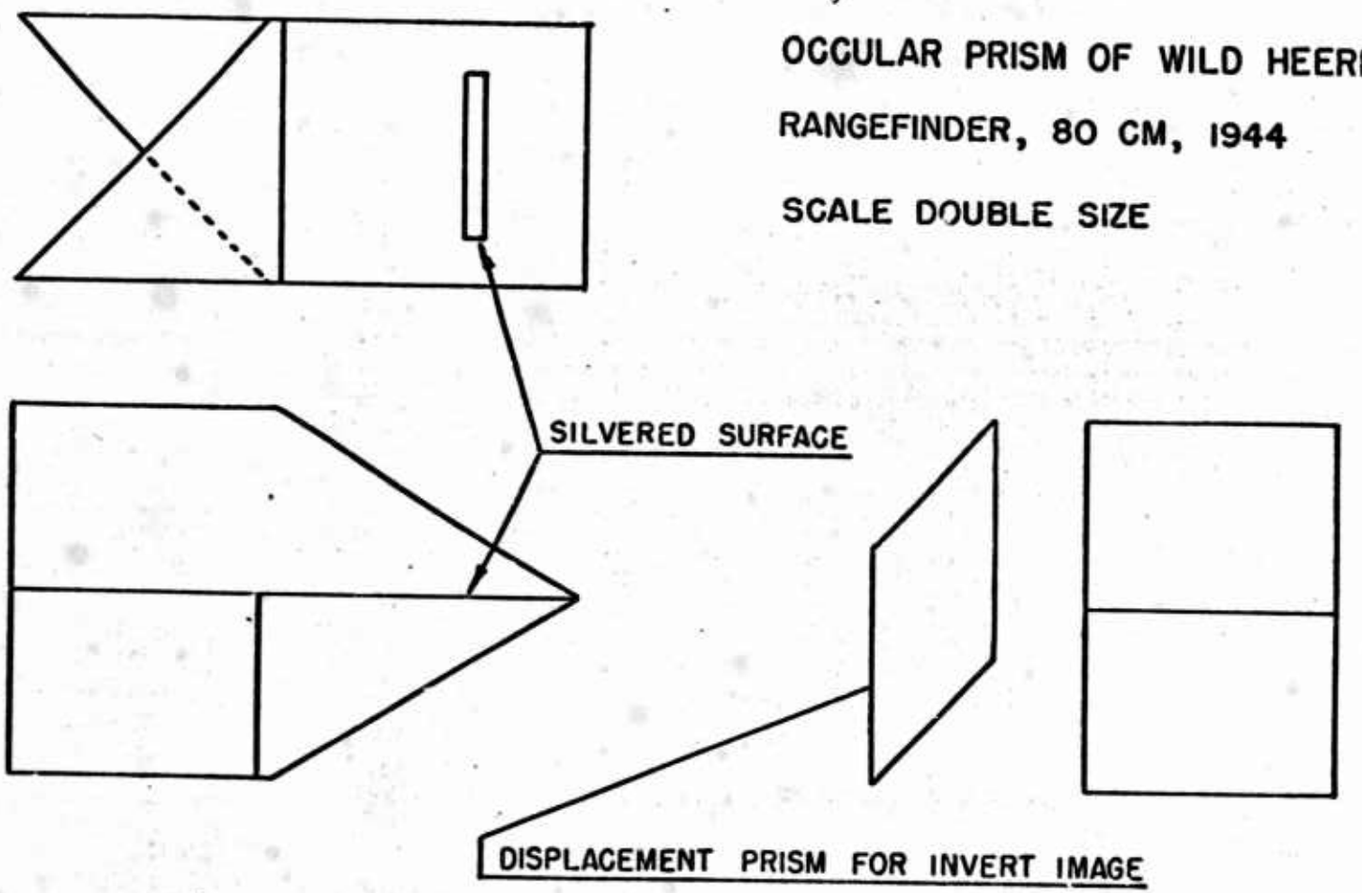
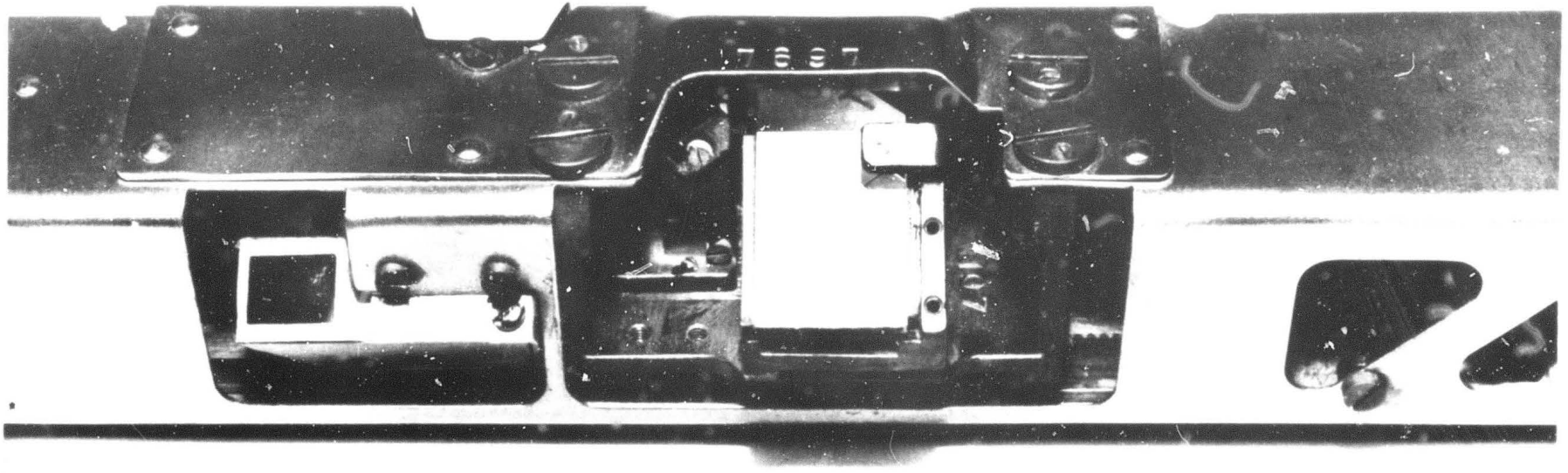


FIGURE 5

INCL. 3



Project No.6-5 OCCULAR PRISM MOUNTING OF WILD HEERBRUGG RANGEFINDER Fig. 6

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